



Alberta Energy and Utilities Board

AGS

Alberta Geological Survey

## EUB/AGS Surficial Geology of the Peerless Lake Area (NTS 84B), Alberta

103-07440/



Stagnant ice moraine on the Peerless Highlands. Photo by R.C. Paulen, 2001

1. MAP 265 Surficial Geology of the Southeast Buffalo Head Hills Area, (NTS84B/NW) 1:100 000 scale
2. MAP 266 Surficial Geology of the Lubicon Lake Area, (NTS84B/SW) 1:100 000 scale
3. MAP 267 Surficial Geology of the Peerless Highlands Area, (NTS84B/NE) 1:100 000 scale

4. MAP 268 Surficial Geology of the Trout River Area, (NTS84B/SE) 1:100 000 scale

## Background

Mineral exploration for kimberlite, uranium and base and precious metals continues to be active in northern Alberta. The Peerless Lake area has been subjected to several minor Quaternary studies by the Alberta Geological Survey (AGS) since 1992 and has been actively explored for diamonds in recent years (Fenton and Pawlowicz 1997; Pawlowicz et al. 1999). As part of a multi-year program initiative, AGS conducted a surficial mapping program in 2001-2002. The impetus for this recent study is the discovery of 36 kimberlite pipes in the Buffalo Head Hills - Loon River Lowlands. At least 50 per cent of these kimberlites are known to contain some diamonds. Quaternary studies in the Peerless Lake region have important implications for mineral exploration using drift prospecting.

Northern Alberta (north of latitude 55°N, or approximately Lesser Slave Lake) is covered by approximately 15 1:250 000-scale map areas that are either unmapped or inadequately mapped with respect to surficial geology, Quaternary stratigraphy, bedrock topography and drift thickness. AGS is currently conducting a multi-year initiative to complete the surficial mapping coverage of northern Alberta. The purpose of this program is to provide the minerals industry with baseline geological information in support of mineral exploration in northern Alberta. Multi-year objectives are to complete the Quaternary geology investigations of northern Alberta, including surficial geology mapping, and stratigraphic and thematic studies. Additional objectives are to provide data and interpretations for northern Alberta, including maps, reports and information sets in electronic and, when required, hard copy.

## Study Area

This CD contains information from the AGS mapping program that focused on the Peerless map area (NTS 84B); included are maps of the surficial geology. Interim results have been released through presentations and posters at the 2001 and 2002 Calgary Mineral Exploration Group's Calgary Mining Forum & Alberta Geological Survey Minerals Section Open House (Pawlowicz and Fenton 2001; Paulen et al. 2002a; 2002b; Pawlowicz and Fenton 2002a) and Geological Association of Canada (GAC) annual meeting in 2002 (Paulen et al. 2002c; Pawlowicz and Fenton 2002b). Subsequent CDs will contain information on bedrock topography, drift thickness and files with information on the surface site samples, analyses run and holes drilled.

Specific geological highlights include:

- Outcrops of kimberlite (e.g., K5 and K6) occur in the Buffalo Head Hills forming small prominent knobs above the surrounding stagnant ice terrain.
- On the Buffalo Head Hills, areas of thin (<2 m) till overlie sandstone and shale bedrock were discovered. The occurrence of these outcrops were previously unknown and palynological analysis shows the bedrock is an outlier of Wapiti Formation sandstone of Late Campanian age. This is considerably younger than the mapped Smoky Group. Additionally, thin veneers of preglacial (Tertiary?) quartzite gravels discontinuously overlie the bedrock on these areas of shallow drift cover.
- An extensive esker and ice-contact meltwater complex was observed in the southwest corner of the map area. Other notable

glaciofluvial features include the Trout River meltwater channel, which occurs near the western edge of the Peerless Highlands, and a kame complex adjacent to Gods Lake. These are excellent sources of aggregate in a region that has limited aggregate resources.

- Flutings scoured into the bedrock on the Buffalo Head Hills and a well-preserved crag and tail landform at the K5 kimberlite outcrop provided information on regional (glacial maximum) ice flow which advanced in a west-southwesterly direction across the map area.
- Flutings and linear landforms on the northeastern flank of the Peerless Highlands indicate a south-southeasterly ice flow. This suggests that late-stage ice was deflected due to topographic control of the thinning ice sheet.
- A rare boulder pavement was also discovered at the Red Earth airport. Striae measured from the planed tops of the boulders indicate the surface till in the Loon River Lowlands was deposited by ice flowing southward ( $188^{\circ}$ ).
- Beautifully preserved flutings in the Trout River map area suggest the latest southwesterly flowing ice re-advanced into a large glaciolacustrine lake that occupied the Wabasca River lowland to the northeast.

This project also helped implement a more holistic approach for field digital data capture and handling. All field notes were collected in the last year used the Palm hardware and Pendragon software. This allowed notes to be transferred to an Access database that was linked to ArcView. Up-to-date maps of sample and observation sites were available each evening.

Initial preliminary maps were compiled using 1:60,000 scale air photographs flown in 1986, supplemented by Landsat 7 satellite data. After field checking, the revised surficial maps were digitized into ArcInfo. Following review and editing, the final map products were prepared.

### Navigation of Files

This compact disc constitutes release of maps 265, 266, 267 and 268 prepared for the Alberta Energy Utilities Board/Alberta Geological Survey (EUB/AGS) by R.C. Paulen, M.M. Fenton, J.C. Campbell and J.G. Pawlowicz. The intent is to make the maps available in a variety of common digital formats to meet the needs of two groups of users: GIS operators and those requiring an exact version of the published map in a readily printable format. GIS files are available in ArcInfo Export (.e00) and shapefile formats. The printer-ready files are in Postscript (.eps) format and also in Adobe's Portable Document Format (.PDF).

A brief description follows of each of the folders and how they may be used.

### PDF

This folder contains Adobe® Acrobat PDF documents of the published version of the maps. This format allows viewing on any computer capable of running a suitable version of Adobe® Acrobat Reader®.

A freeware version of Adobe® Acrobat Reader® for Microsoft® Windows® is included on the CD-ROM. Adobe® Acrobat Reader® for other platforms are available from Adobe's Web site at [www.adobe.com](http://www.adobe.com).

To install the software, double-click the "acrobat.exe" file and follow the instructions for installation.

### Postscript

This folder contains postscript files of the published version of the maps. These files can be either imported into a graphics software package or plotted directly from the Windows Explorer window:

1. Right click on the .eps file
2. Select Print, OK
3. Choose a printer from the dropdown list, then click OK.

**Table 1. Contents of folders PDF and Postscript**

| File      | PDF<br>(.pdf) | Postscript<br>(.eps) | Map<br>Number | Title                                                                         | Scale     |
|-----------|---------------|----------------------|---------------|-------------------------------------------------------------------------------|-----------|
| NTS84B_NW | yes           | yes                  | Map 265       | Surficial Geology of the Southeast<br>Buffalo Head Hills Area,<br>(NTS84B/NW) | 1:100 000 |
| NTS84B_SW | yes           | yes                  | MAP 266       | Surficial Geology of the Lubicon<br>Lake Area, (NTS84B/SW)                    | 1:100 000 |
| NTS84B_NE | yes           | yes                  | MAP 267       | Surficial Geology of the Peerless<br>Highlands Area, (NTS84B/NE)              | 1:100 000 |
| NTS84B_SE | yes           | yes                  | MAP 268       | Surficial Geology of the Trout River<br>Area, (NTS84B/SE)                     | 1:100 000 |

### ArcExport (.e00)

Export files in this folder were created from coverages in ArcInfo Version 8.1.2. See Table 2 for projection parameters and Table 3 for coverage descriptions.

### ArcView (shapefiles)

Shapefiles provided were created in ArcView version 3.2a. See Table 2 for projection parameters and Table 3 for shapefile descriptions.

**Table 2. Projection parameters for ArcExport and ArcView files**

|            |     |
|------------|-----|
| Projection | UTM |
|------------|-----|

|              |         |
|--------------|---------|
| Zone         | 12      |
| Datum        | NAD 83  |
| Spheroid     | GRS1980 |
| Scale Factor | 0.9996  |

Table 3. Contents of folders ArcExport and ArcView

| FILE                                                     | ArcExport<br>(.e00) | ArcView<br>(shapefile)<br>(dbf,shx,shp) | Description                                                                                                                                                 |
|----------------------------------------------------------|---------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Peerless_line_features                                   | yes                 | yes                                     | Contains all line features such as eskers and meltwater channels.                                                                                           |
| In84b_sw_83<br>In84b_se_83<br>In84b_nw_83<br>In84b_nw_83 |                     |                                         | FIELD NAME                                                                                                                                                  |
|                                                          |                     |                                         | DESCRIPTION                                                                                                                                                 |
|                                                          |                     |                                         | Type                                                                                                                                                        |
|                                                          |                     |                                         | Numeric code assigned to each line feature. See Table 4 for line feature definitions relating to code.                                                      |
| Peerless_point_features                                  | yes                 | yes                                     | Contains all point features such as bedrock outcrops.                                                                                                       |
| py84b_sw_83<br>py84b_se_83<br>py84b_nw_83<br>py84b_nw_83 |                     |                                         | FIELD NAME                                                                                                                                                  |
|                                                          |                     |                                         | DESCRIPTION                                                                                                                                                 |
|                                                          |                     |                                         | Type                                                                                                                                                        |
|                                                          |                     |                                         | Numeric code assigned to each point feature. See Table 4 for line feature definitions relating to code. See legend on PDF or eps for point feature symbols. |
| Peerless_polys                                           |                     |                                         | Sym_angle                                                                                                                                                   |
|                                                          |                     |                                         | Angle given in degrees representing the direction in which the symbol is rotated.                                                                           |
|                                                          |                     |                                         | Note: ARCVIEWFeb02_28.ttf (true type font) contains custom AGS point symbols                                                                                |
|                                                          |                     |                                         | Contains all surficial geology polygon boundaries for 84B.                                                                                                  |
| pt84b_sw_83<br>pt84b_se_83<br>pt84b_nw_83<br>pt84b_nw_83 |                     |                                         | FIELD NAME                                                                                                                                                  |
|                                                          |                     |                                         | DESCRIPTION                                                                                                                                                 |
|                                                          |                     |                                         | OLabel                                                                                                                                                      |
|                                                          |                     |                                         | Symbolized terrain units according to legend description. See Table 6 or legend on PDF or eps.                                                              |
|                                                          |                     |                                         | Unit_symbol                                                                                                                                                 |
|                                                          |                     |                                         | Provides a generalized text code used to colour code the polygon units.                                                                                     |
|                                                          |                     |                                         |                                                                                                                                                             |
|                                                          |                     |                                         |                                                                                                                                                             |

Table 4. Line and point feature numeric code definitions (Peerless\_line&amp;point\_legend.xls)

| TYPE | FEATURE                |
|------|------------------------|
| 90   | Thermokarst depression |
| 93   | Small landslide        |
| 84   | Large landslide        |

|           |                                           |
|-----------|-------------------------------------------|
| 82        | Eolian dunes                              |
| 70        | Beach or strandline                       |
| 71        | Wave cut bench                            |
| 72        | Escarpment                                |
| 64        | Meltwater channel (minor)                 |
| 63        | Meltwater channel (minor, flow indicated) |
| 62        | Meltwater channel (major)                 |
| 61        | Meltwater channel (major, flow indicated) |
| 68        | Crevasse filling                          |
| 65        | Ice contact slope                         |
| 91        | Kettle                                    |
| 67        | Esker, unknown direction                  |
| 66        | Esker, known direction                    |
| 13        | Drumlinoid or streamlined landform        |
| 14        | Drumlinoid, down-ice flow indicated       |
| 80        | Buried drumlinoid or streamlined landform |
| 95        | Major moraine ridge                       |
| 74        | Minor moraine ridge                       |
| 92 and 97 | Ice thrust ridge (straight and curved)    |
| 77        | Striation (direction unknown)             |
| 76        | Striation (direction known)               |
| 94        | Bedrock outcrop                           |
| 95        | Gravelsand pit                            |

### Acknowledgements

Initial fieldwork was carried out by AGS during the summers of 1997, 1998 and 1999. Surficial mapping was completed in 2001 under AGS's Quaternary mapping initiative. Jill Weiss and Charlene Brightwell provided assistance with fieldwork and compilation of the digital databases. Digital cartography and GIS was completed by Monica Price, Joan Waters, Natasha Blundon and Jill Weiss. D. Goulet performed the lab analyses (texture, Chitick, and initial geochemical sample preparation).

### References

Fenton, M.M. and Pawlowicz, J.G. 1997. Diamond indicator mineral anomaly from till sample site NAT95-134. Alberta Energy and Utilities Board, EUB/AGS Geo-Note 1997-01.

- Paulen, R.C., Fenton, M.M. and Pawlowicz, J.G. 2002a. Late Wisconsin Ice Flow History in the Peerless Lake Area (NTS 84B): Implications for Exploration. Program with Abstracts, The 11th Annual Calgary Mining Forum & Alberta Geological Survey Minerals Section Open House, New Searches and the Western Frontier 2002, Calgary, p. 36. *Also in:* Alberta Geological Survey and Industry Contributions from the 11th Annual Calgary Mining Forum and Alberta Geological Survey Minerals Section Open House, Alberta Energy and Utilities Board, EUB/AGS Information Series 125.
- Paulen, R.C., Fenton, M.M., Pawlowicz, J.G., Weiss, J.A., Price, M. and Campbell, J.E. 2002b. Preliminary Surficial Geology of the Peerless Lake Area (NTS 84B). Program with Abstracts, The 11th Annual Calgary Mining Forum & Alberta Geological Survey Minerals Section Open House, New Searches and the Western Frontier 2002, Calgary, p. 63. *Also in:* Alberta Geological Survey and Industry Contributions from the 11th Annual Calgary Mining Forum and Alberta Geological Survey Minerals Section Open House, Alberta Energy and Utilities Board, EUB/AGS Information Series 125.
- Paulen, R.C., Fenton, M.M., Pawlowicz, J.G., Weiss, J.A. and Campbell, J.E. 2002c. Surficial geology of the Peerless Lake Area (NTS 84B). Program with abstracts, 2002 GAC/MAC, Saskatoon, p. 89.
- Pawlowicz, J.G., Meeks, J.O., and Fenton, M.M. 1999. Auger core descriptions, 1998 drilling, Peerless Lake map sheet (NTS 84B), North-Central Alberta. Alberta Energy and Utilities Board, EUB/AGS Open File Report 1998-09.
- Pawlowicz, J.G. and Fenton, M.M. 2001. Peerless Lake area (NTS 84B) bedrock topography and drift thickness. Program with Abstracts, The 10th Annual Calgary Mining Forum & Alberta Geological Survey Minerals Section Open House, New Resources for the New Economy 2001, Calgary, p. 58. *Also in:* Alberta Geological Survey and Industry Contributions from the 11th Annual Calgary Mining Forum and Alberta Geological Survey Minerals Section Open House, Alberta Energy and Utilities Board, EUB/AGS Information Series 123.
- Pawlowicz, J.G. and Fenton, M.M. 2002a. Bedrock topography, drift thickness and subcrop geology of the Peerless Lake area, NTS 84B: an update. Program with Abstracts, The 11th Annual Calgary Mining Forum & Alberta Geological Survey Minerals Section Open House, New Searches and the Western Frontier 2002, Calgary, p. 37. *Also in:* Alberta Geological Survey and Industry Contributions from the 11th Annual Calgary Mining Forum and Alberta Geological Survey Minerals Section Open House, Alberta Energy and Utilities Board, EUB/AGS Information Series 125.
- Pawlowicz, J.G. and Fenton, M.M. 2002b. Bedrock topography, drift thickness and subcrop geology of the Peerless Lake area, NTS 84B: an update. Program with abstracts, 2002 GAC/MAC, Saskatoon, p. 90.

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